

# Homework 1

February 1, 2022

Jose Carlos Munoz

ex1)

We assume that in this Neural Network that there is a hidden layer and an output layer. The Hidden layer will contain 2 nodes. The preactivation function will transform the values. Once the ReLU function is used, it will create a pair of  $\{(0, 0), (0, 0)\}$  for the first 2 pairs and for the other it  $\{(1, 0), (0, 1)\}$ . These new values can easily be linearly separable.

ex4)

	$X_1$	$X_2$	$Y$
$a_0$	-1	-1	-1
$a_1$	1	1	-1
$a_2$	1	-1	1
$a_3$	-1	1	1

(1)

We know to linearly separate the points we use the equation  $\vec{w}_{i+1} = \vec{w}_i + \alpha * y * a_i$ . We use this equation to iterate through until there is no change of the  $\vec{w}$ .

The Starting  $\vec{w}$  is  $\{0, 0\}$  with an  $\alpha = 1$

Step 1)

$$\begin{aligned}\vec{w}_1 &= \vec{w}_0 + \alpha * (-1) * a_0 \\ &= \{1, 1\}\end{aligned}\tag{1}$$

Step 2)

$$\begin{aligned}\vec{w}_2 &= \vec{w}_1 + \alpha * (-1) * a_1 \\ &= \{2, 2\}\end{aligned}\tag{2}$$

Step 3)

$$\begin{aligned}\vec{w}_3 &= \vec{w}_2 + \alpha * (-1) * a_2 \\ &= \{3, 1\}\end{aligned}\tag{3}$$

Step 4)

$$\begin{aligned}\vec{w}_4 &= \vec{w}_3 + \alpha * (1) * a_3 \\ &= \{2, 2\}\end{aligned}\tag{4}$$

Step 5)

$$\begin{aligned}\vec{w}_5 &= \vec{w}_4 + \alpha * (-1) * a_0 \\ &= \{1, 1\}\end{aligned}\tag{5}$$

Step 6)

$$\begin{aligned}\vec{w}_6 &= \vec{w}_5 + \alpha * (-1) * a_1 \\ &= \{2, 2\}\end{aligned}\tag{6}$$

After a few Cycles, we see that it will not converge at all. This is because these points can not be linearly separated.